



Extended Range Guided Munition Missions & Capabilities

Transforming Fires in the 21st Century

Presented at the
NDIA/TACOM-ARDEC Science & Technology Symposium

May 2002

Brian D. O'Cain
ERGM Program Manager
Raytheon Company

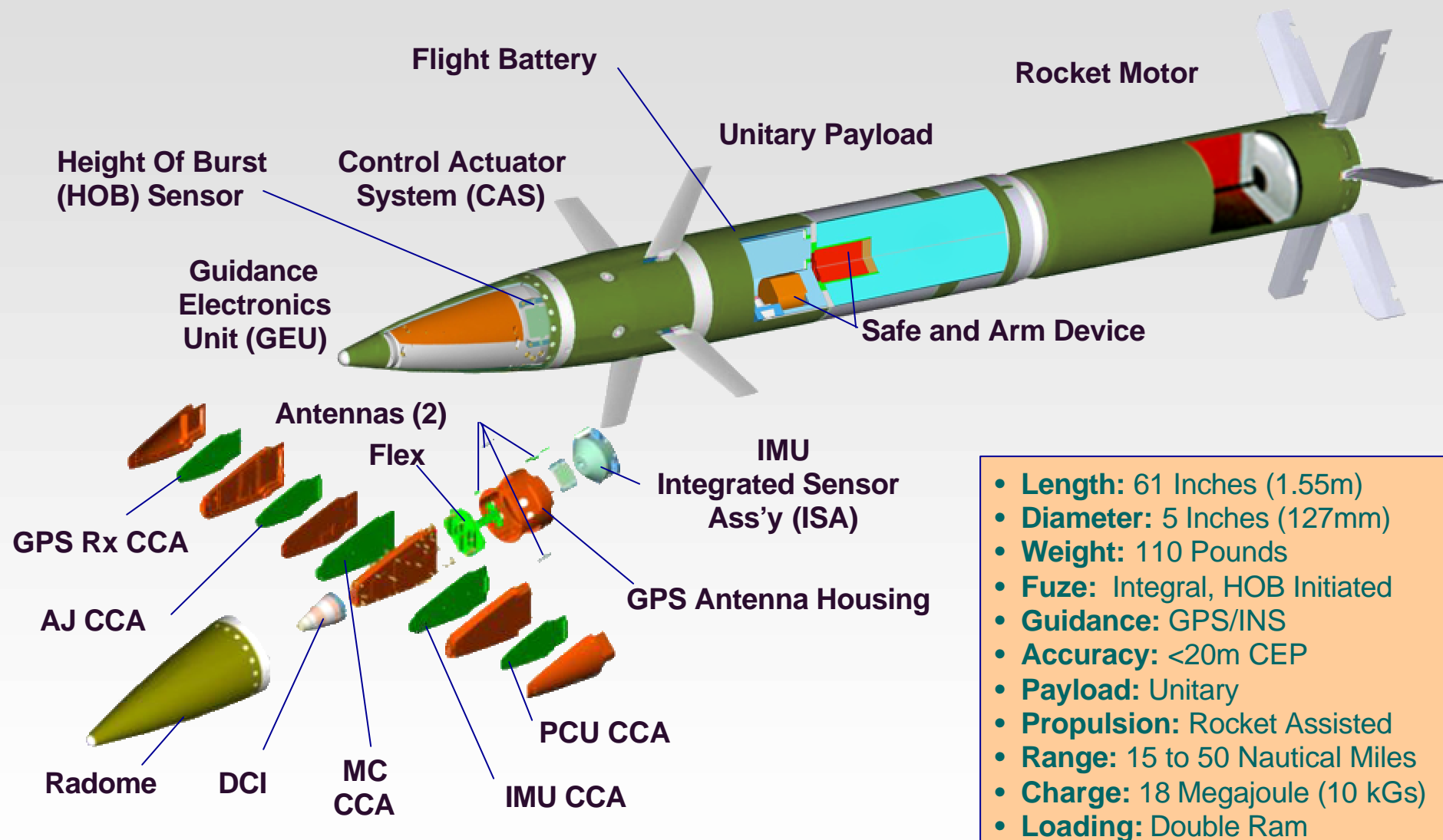


Discussion Topics

- **ERGM Design & Status**
- **Mission Effects**
- **Guided Projectile ConOps**
 - **STOM Scenario**
 - **Combined Arms Scenario**
- **Future Capabilities**
- **Summary**



Extended Range Guided Munition

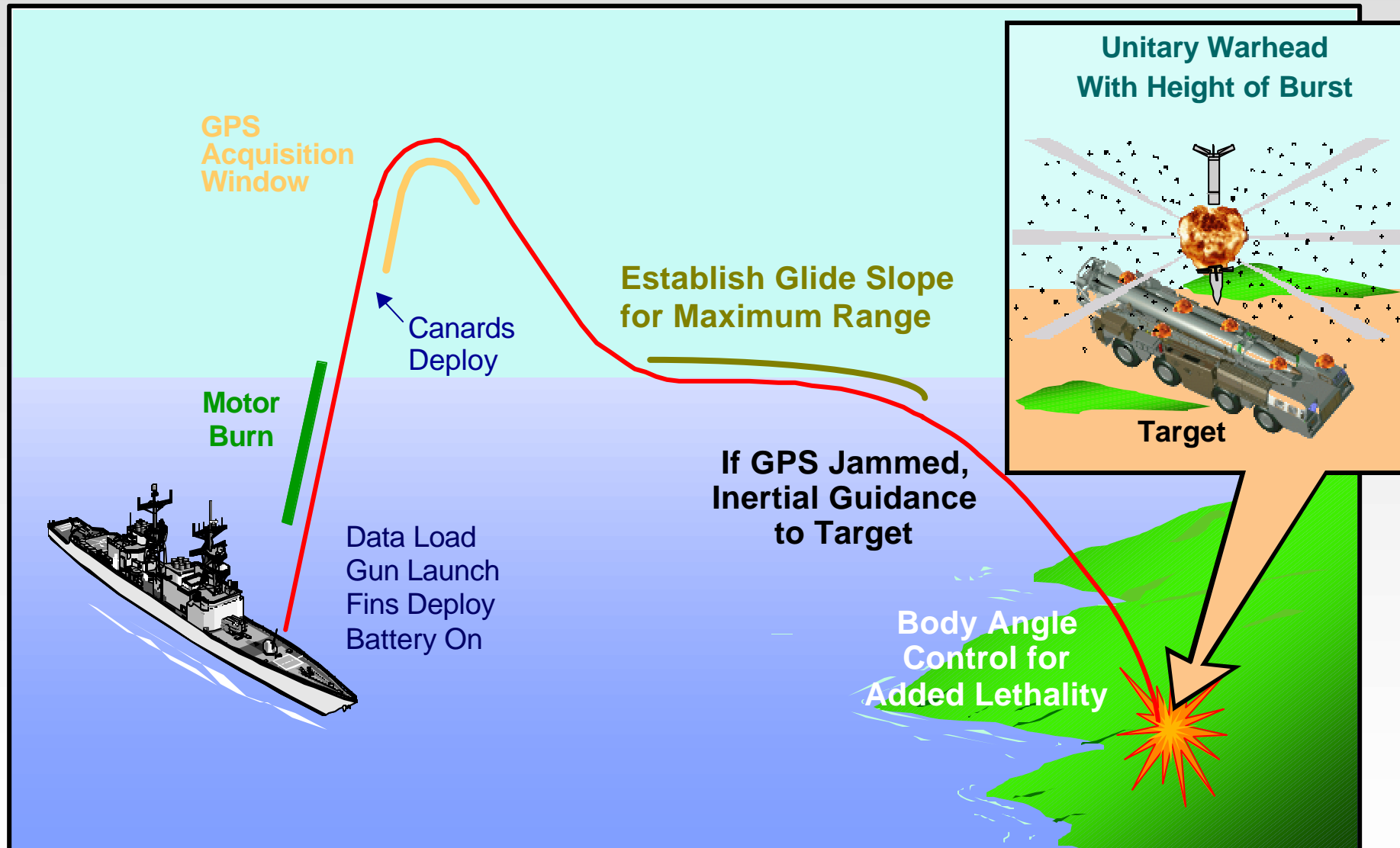


Extended Range Guided Munitions

Raytheon



ERGM Concept of Operations



Extended Range Guided Munitions

Raytheon



Development Status

- **Two Successful Flight Tests to Date**
 - **Autonomous GPS Acquisition & Navigation in CTV2**
 - Included IMU Guidance, GPS Handover & Reacquisition
 - **Excellent Autopilot Control of Airframe in CTV1**
 - **Supports 6 DoF Multiple Rounds Simultaneous Impact (MRSI) & Reverse Slope Capability**
- **Gun Shock Validation Testing Successful**
 - **Everything Proven to Survive 12,000g with Margin**
 - Nominal Gun Launch is 10,100g
- **New Unitary Warhead Meets ORD Target Requirements**
 - **November Arena Tests Showed Excellent Results**
 - Penetrated Flak Vests & Helmets, Disabled Truck
 - Good Area Effects with Fragment Density & Velocity
 - **Development in Progress**
 - Validation Testing Leads to Flight Demonstration Next Year



Naval Surface Fire Support Missions

- Group objectives per Gen. Hanlon letter to identify specific weapon requirements
- Identify overlaps in effects based requirements

Volume Fires Effects & Roles

- Harassment*
- Suppression*
- Preparation Fires*
- Reconnaissance by Fire*
- Obscuration Fire

Guided Fires Effects & Roles

- Destruction*
- Neutralization*
- Interdiction*
- Counter Fires*
- SEAD*
- Protective Fires*
- Close Support*
- Screening Fires

Precision Strike Effects

Destruction of Specific
Stationary, Moving and
Re-locatable Targets

Guided Fires gives you both Volume and Guided Fires effects

* These effects are part of the current ERGM ORD

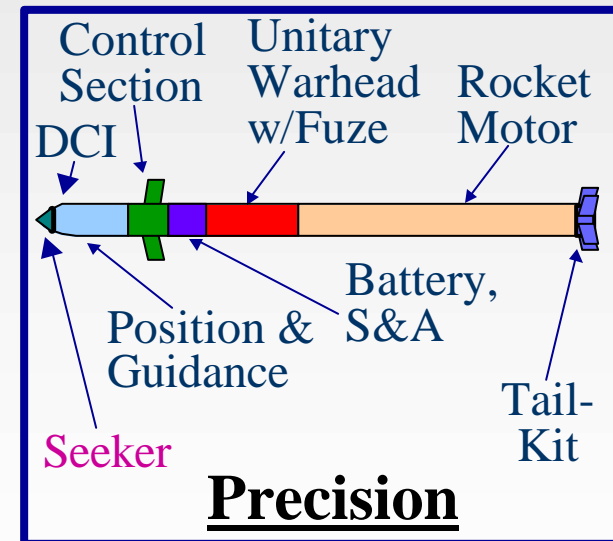
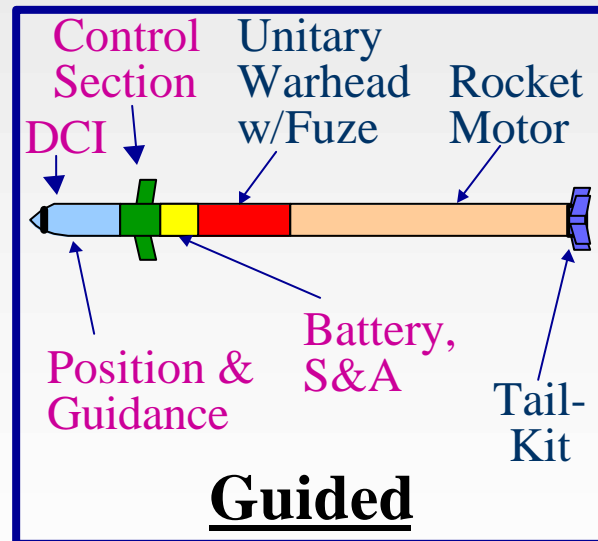
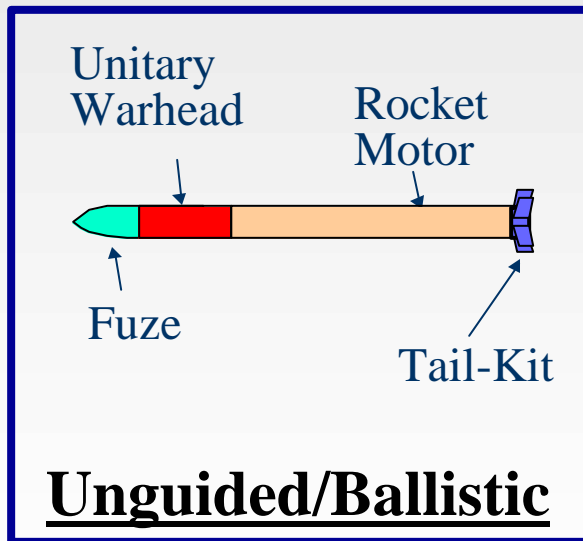
Extended Range Guided Munitions

Raytheon



Guided Projectile Design Types

- Marine's mission effects requirements dictate projectile performance
- Performance drives design
- Design functionality determines components

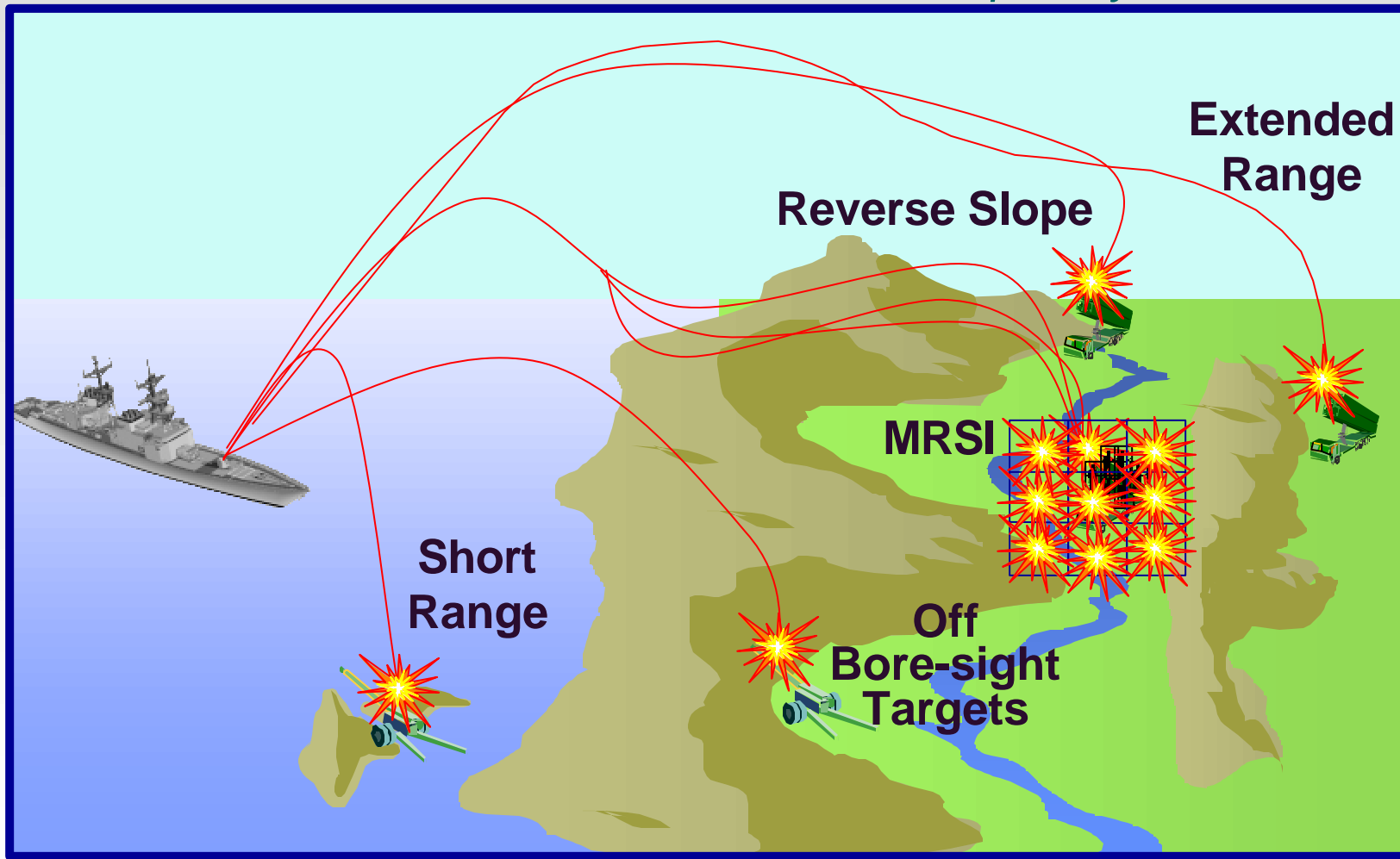


Range → Range + Accuracy → Range + Moving Targets



ERGM Operational Capabilities

Robust Airframe Control Adds Capability



Off bore-sight targets require a Fire Control System P3I upgrade to utilize this capability

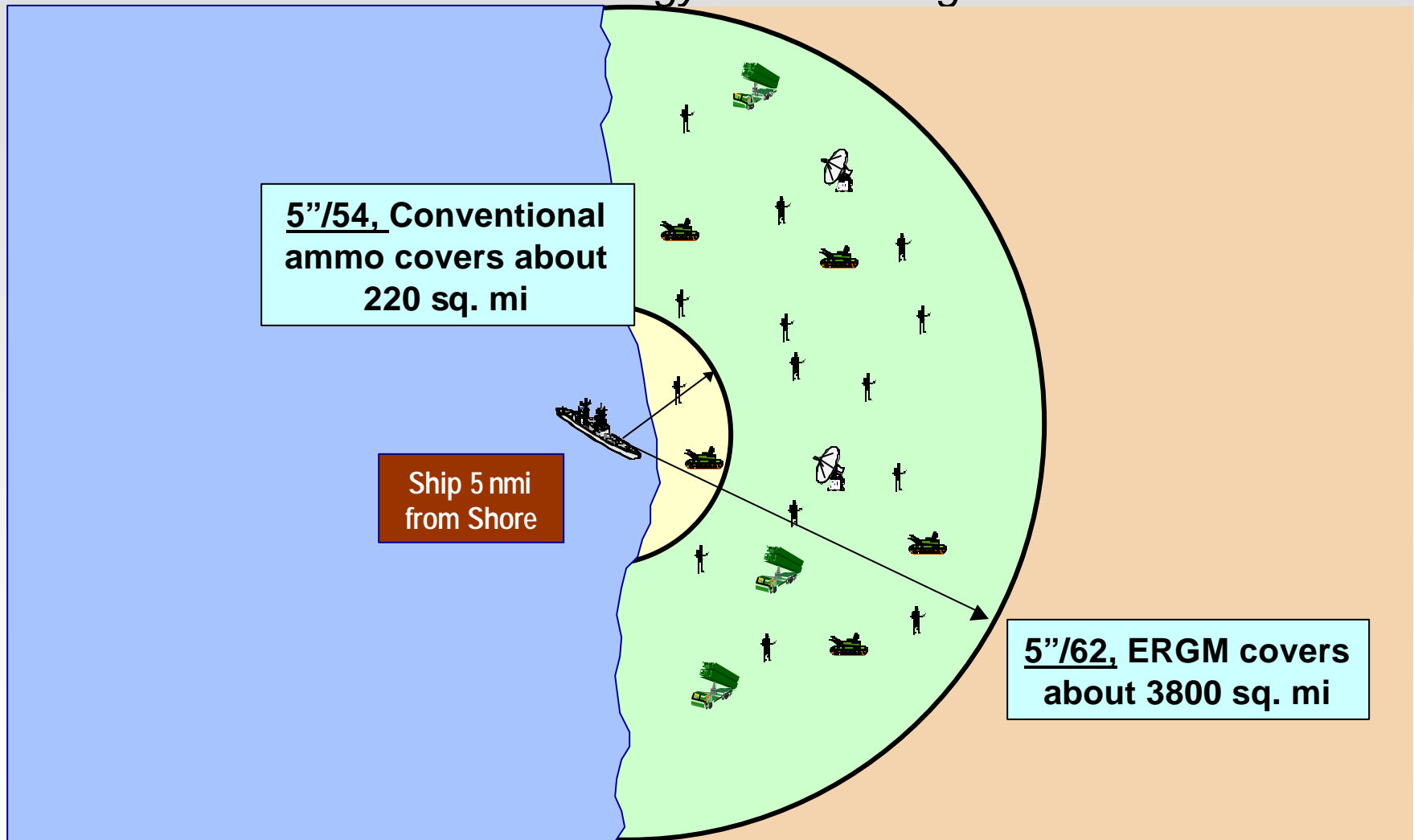
Extended Range Guided Munitions

Raytheon



More Range Means More Targets Can Be Engaged

More Energy = More Range



Extended Range Guided Munitions

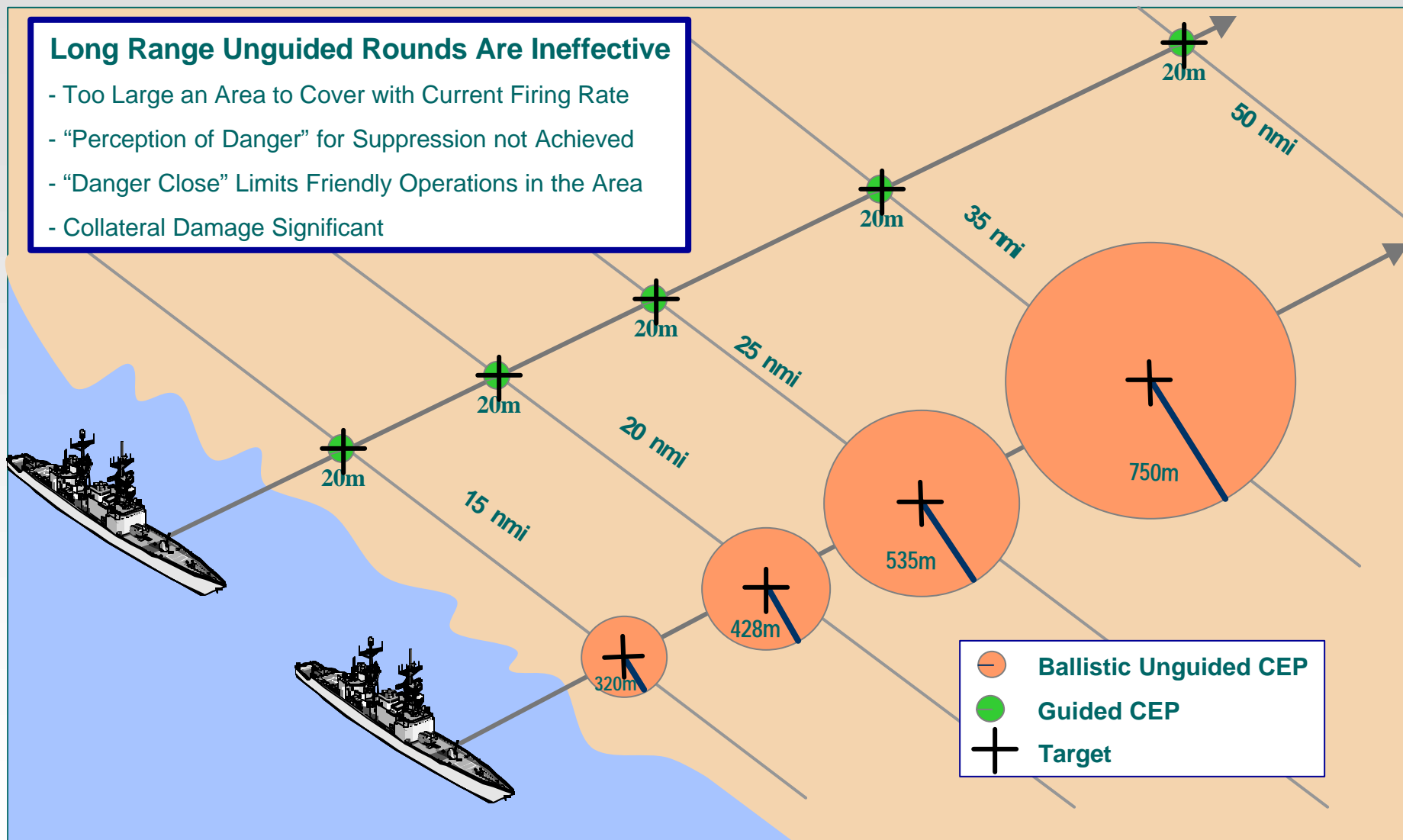
Raytheon



Ballistic and Guided Fires Accuracy

Long Range Unguided Rounds Are Ineffective

- Too Large an Area to Cover with Current Firing Rate
- "Perception of Danger" for Suppression not Achieved
- "Danger Close" Limits Friendly Operations in the Area
- Collateral Damage Significant

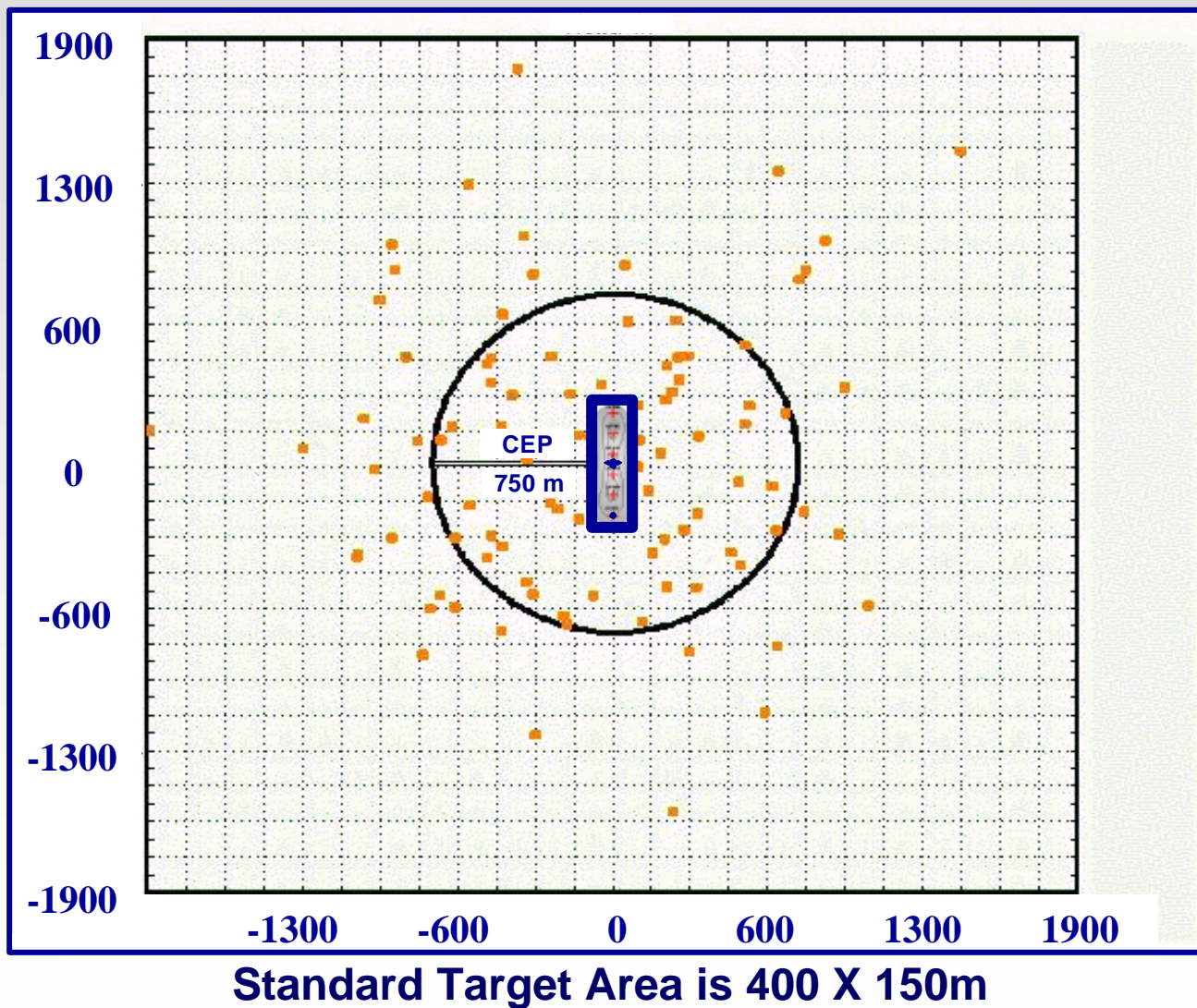


Extended Range Guided Munitions

Raytheon



Unguided Ballistic Dispersion Pattern @ 35 nmi





ERGM Accuracy Minimizes Collateral Damage



Collateral Damage With Current CEP

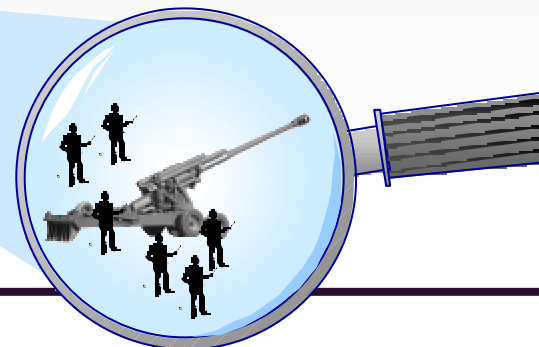
- 68 Conventional Artillery Rounds fired
- Numerous Non-Target Structures Hit
- 1 Hit on Target
- Representative of a 10Km shot. Collateral Damage Would Be Even Greater With Longer Range Shots



ERGM Collateral Damage

- 6 ERGM Rounds Fired
- Primary Target Hit Consistently
- Minimal Collateral Damage
- ERGM GPS Accuracy Consistent At All Ranges

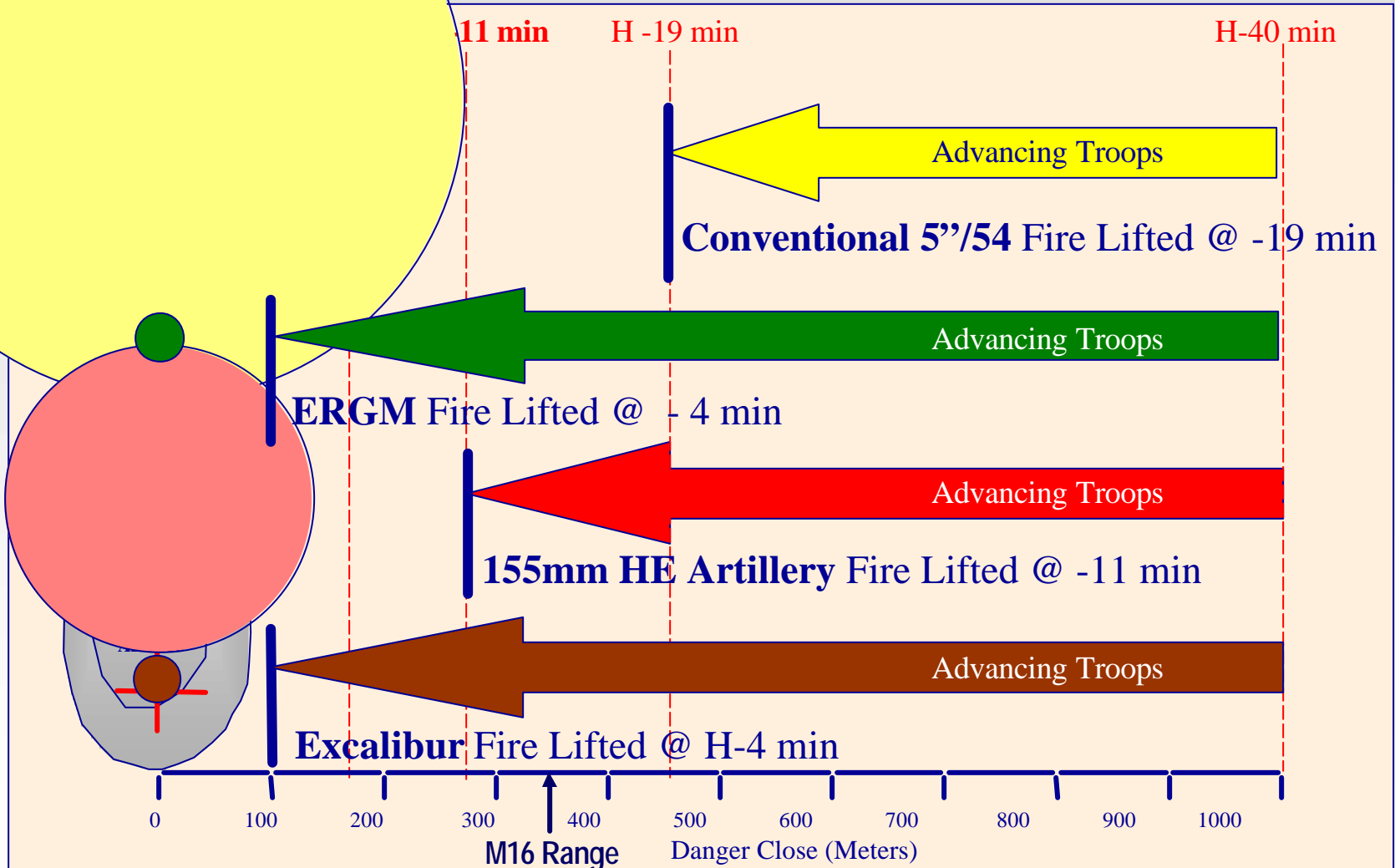
Extended Range Guided Munitions



Raytheon

Close With and Destroy the Enemy...

Danger Close - Advancing Under Artillery Cover



Extended Range Guided Munitions

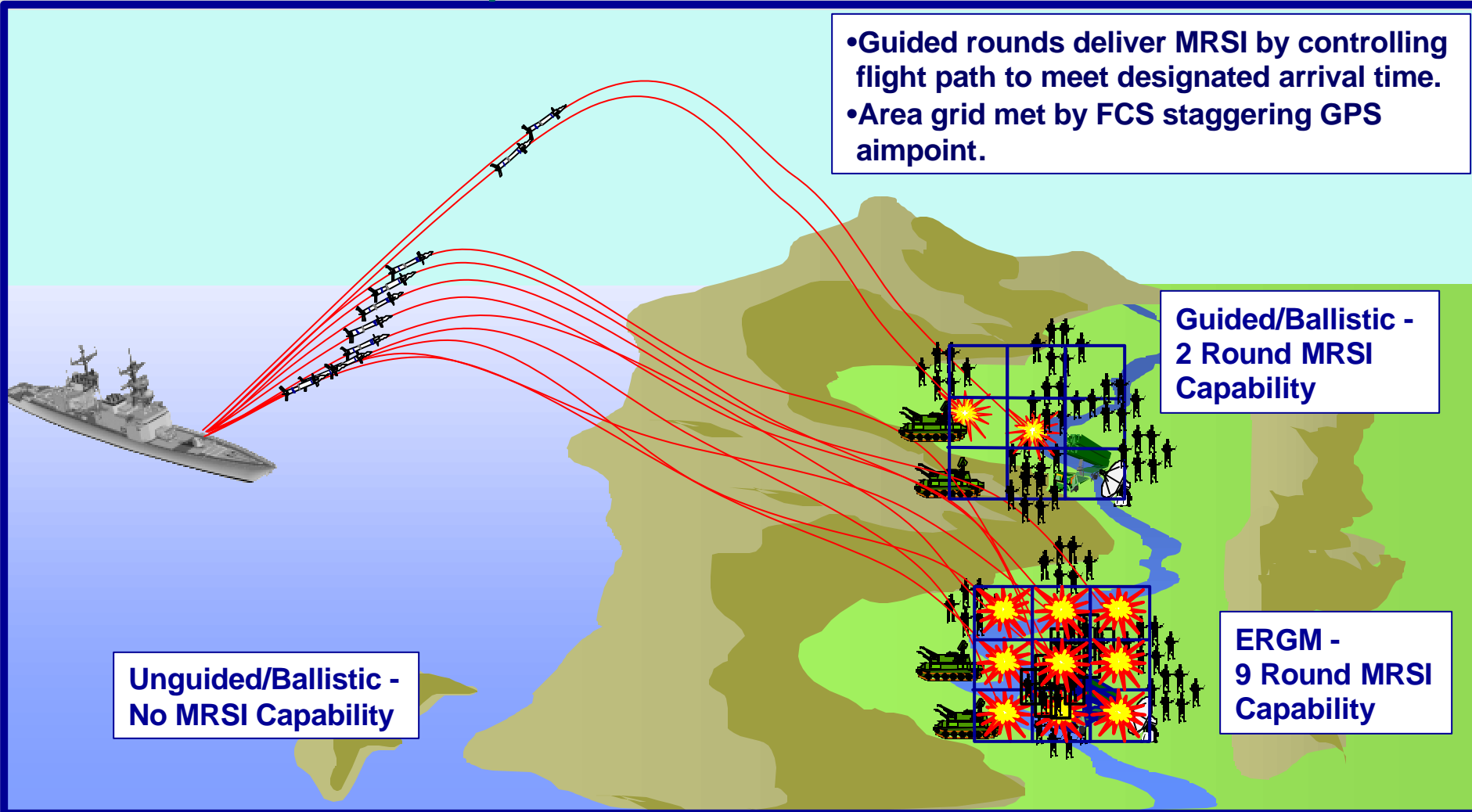
Raytheon



Benefits of Multiple Round Simultaneous Impacts (MRSI)

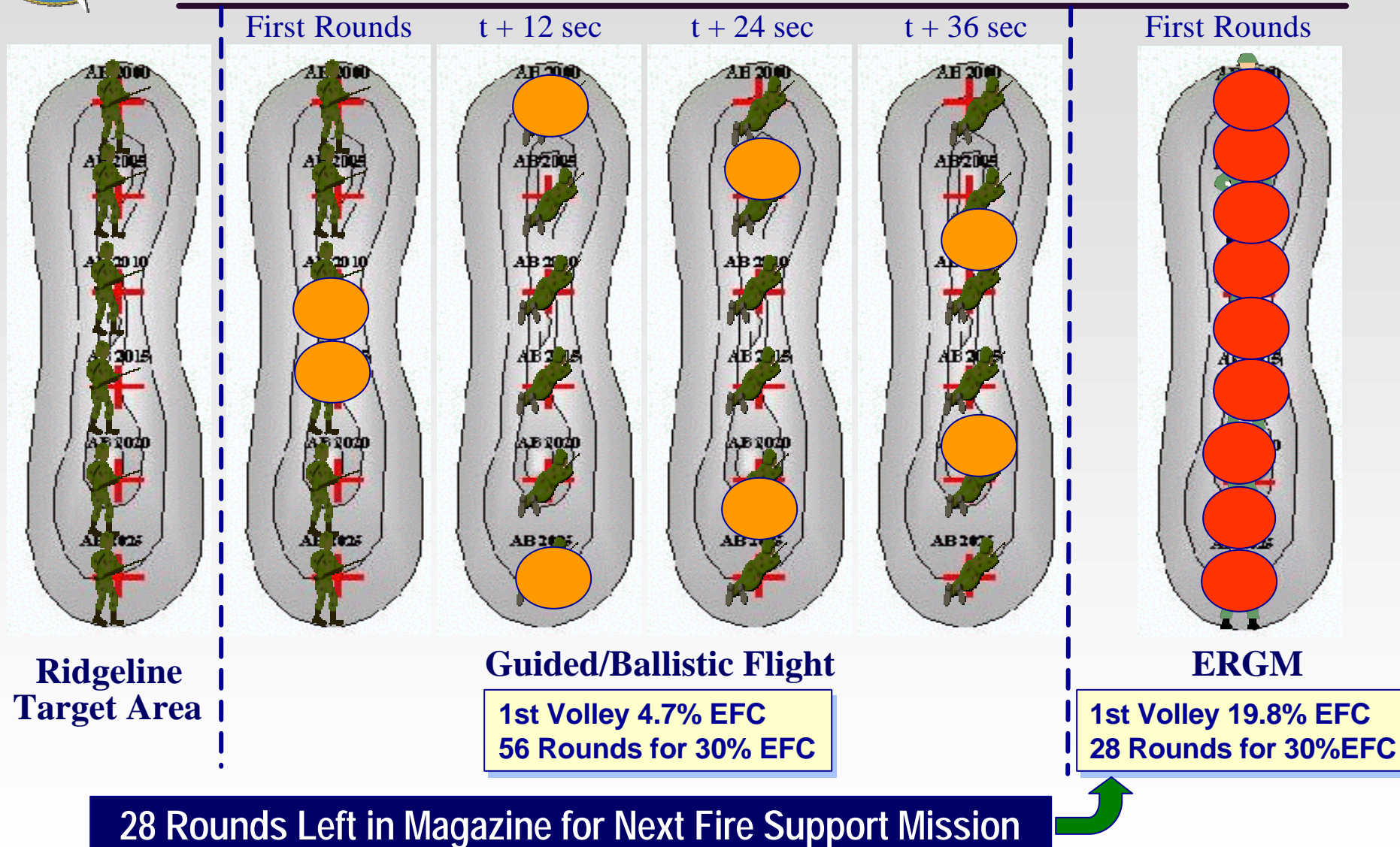
First Round Impacts Give Maximum Volume Fire Effects

- Guided rounds deliver MRSI by controlling flight path to meet designated arrival time.
- Area grid met by FCS staggering GPS aimpoint.





Volume Fire Effects Achieved By MRSI



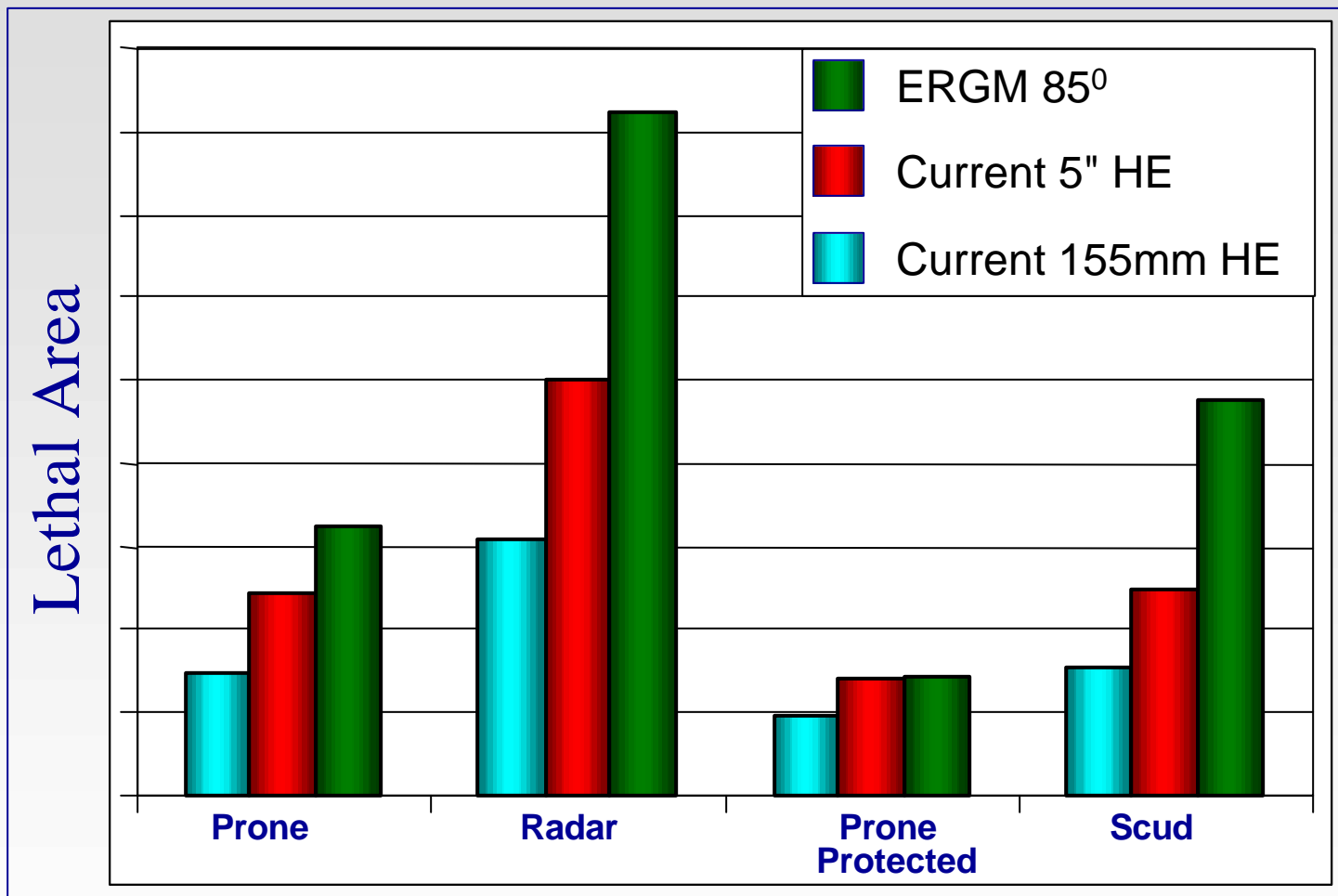
EFC - Effective Fractional Casualty: is a standard measure of kill criteria

Extended Range Guided Munitions

Raytheon



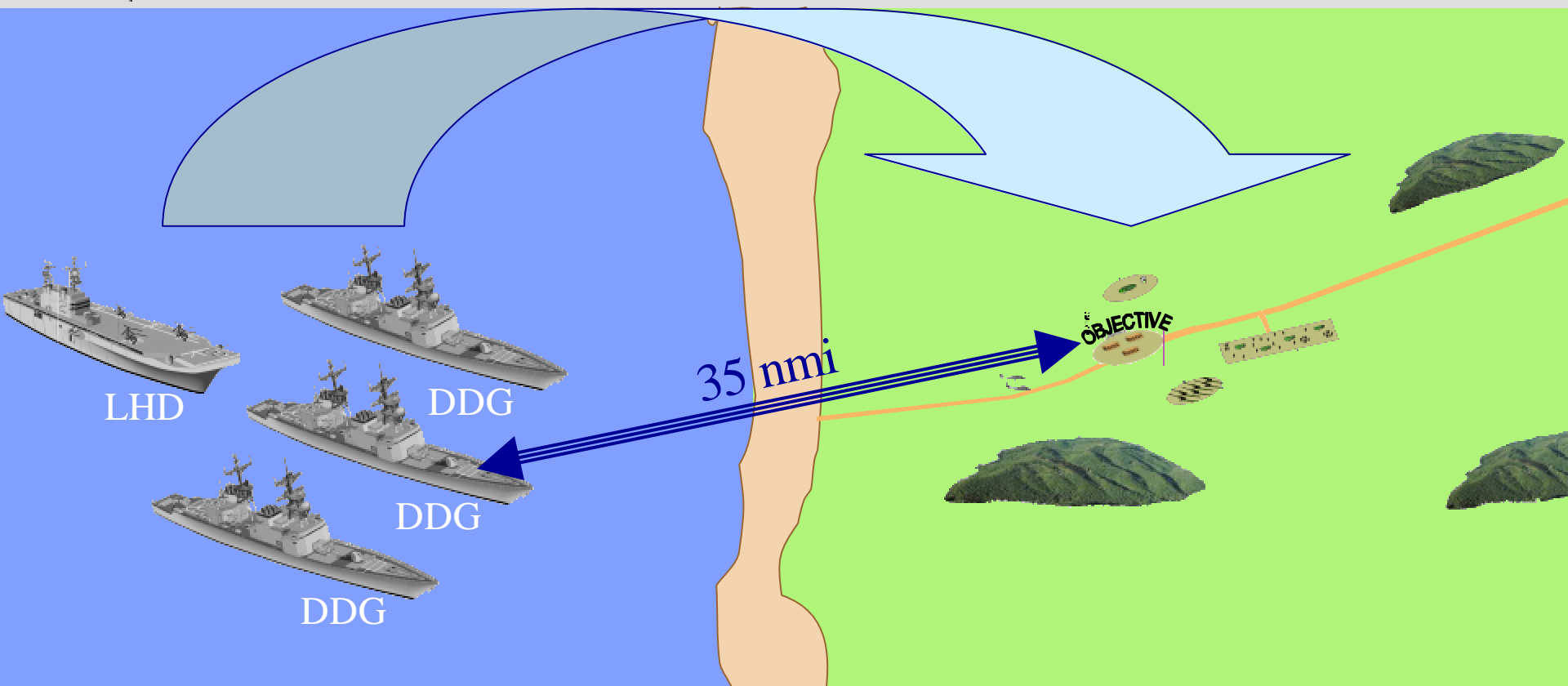
ERGM Lethality Greater Than Current Ammo



Near Vertical Terminal Angle Means Greater Lethality



Ship to Objective Maneuver (STOM)



Mission: Helo raid to seize suspected WMD

Fire Support: Neutralize enemy while limiting civilian casualties with 3 DDG's



Unguided Ballistic Volume Fire Effects

**Three Ships Aiming
At Suppression Zone**



Unable to Achieve Scheduled Fires Mission!



Guided Ballistic Effects

Elapsed
Time

H+ 0 Sec

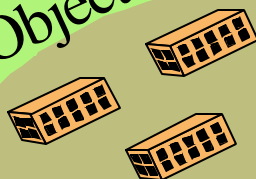
Cumulative
Impacts

6

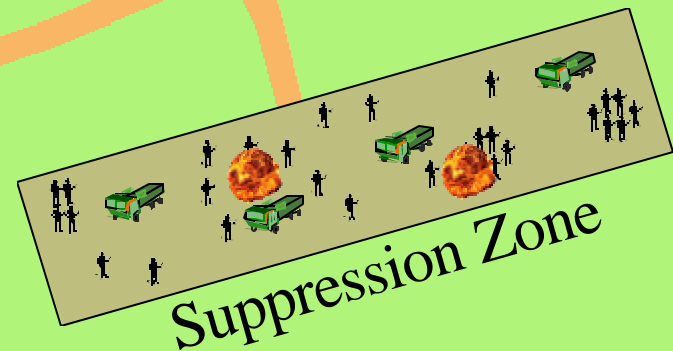
Target 1



Objective

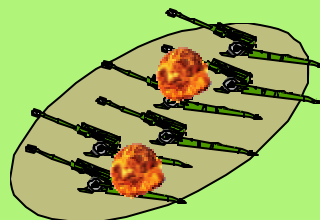


Targets Of
Opportunity



Suppression Zone

Target 2



Extended Range Guided Munitions

Raytheon



Guided Ballistic Effects

Elapsed
Time

H+30 Sec

Cumulative
Impacts

15

Target 1

TARGET
NEUTRALIZED

Objective

Targets Of
Opportunity

Suppression Zone

Target 2

Extended Range Guided Munitions

Raytheon



Guided Ballistic Effects

Elapsed
Time

H+60 Sec

Cumulative
Impacts

24

Target 1

TARGET
NEUTRALIZED

Objective

Targets Of
Opportunity

Suppression Zone

Target 2

Extended Range Guided Munitions

Raytheon



ERGM Effects

Elapsed
Time

H+ 0 Sec

Cumulative
Impacts

27

Target 1

TARGET
NEUTRALIZED

Objective

Targets Of
Opportunity

Suppression Zone

Target 2

Extended Range Guided Munitions

Raytheon



ERGM Effects

Elapsed
Time

H+30 Sec

Cumulative
Impacts

36

Target 1

TARGET
NEUTRALIZED

Objective

Targets Of
Opportunity

Suppression Zone

TARGET
NEUTRALIZED

Target 2

Extended Range Guided Munitions

Raytheon



ERGM Effects

Elapsed
Time

H+60 Sec

Cumulative
Impacts

43

Target 1

TARGET
NEUTRALIZED

Objective

Targets Of
Opportunity

TARGET SUPPRESSED
Suppression Zone

TARGET
NEUTRALIZED

ERGM Available For Targets Of Opportunity

Extended Range Guided Munitions

Raytheon



STOM Scheduled Fires Summary

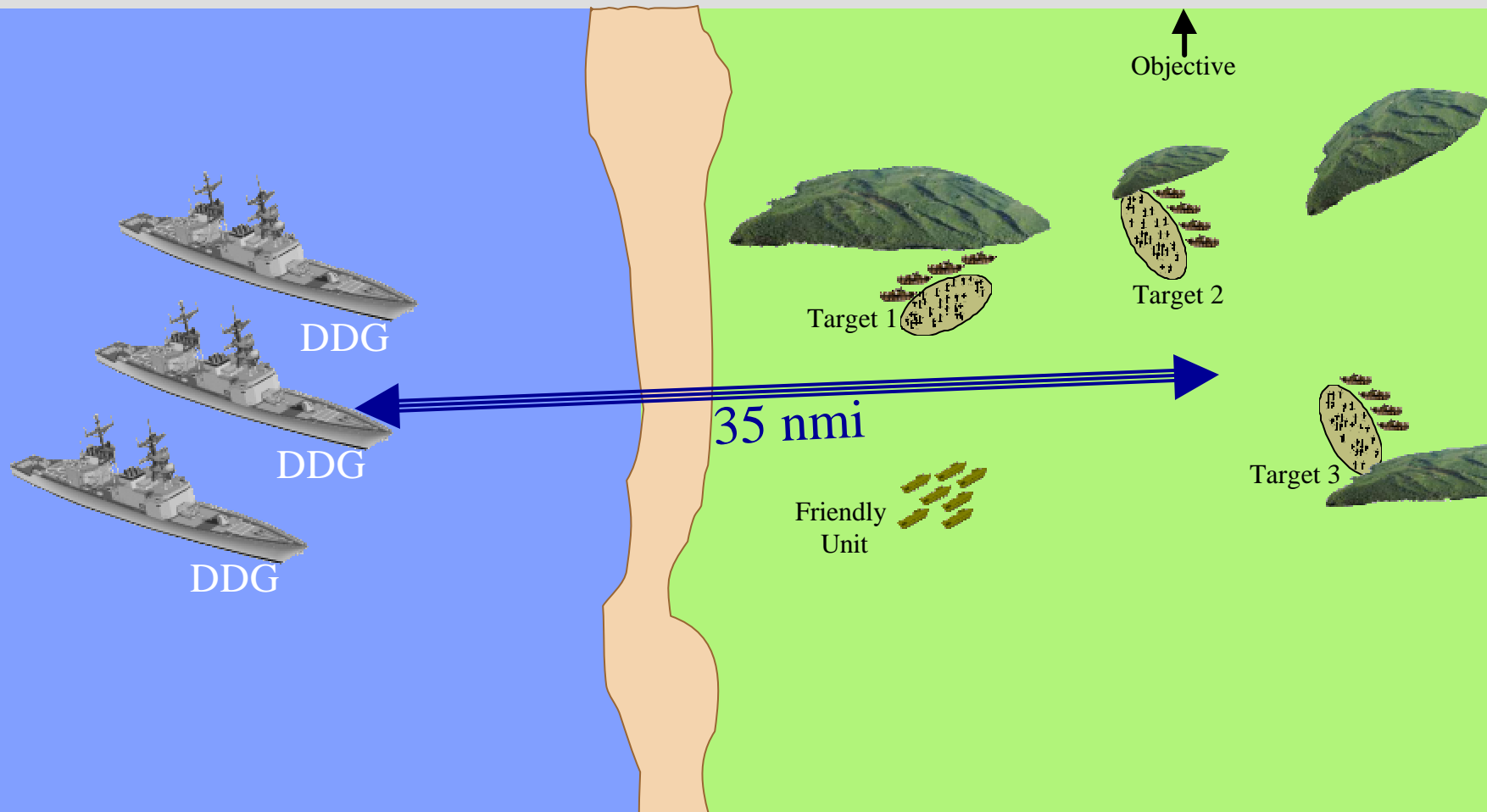
Type of Round Impacted	First Volley Effects	Rounds Used to Complete Scheduled Fires	Time to Complete Scheduled Fires
Unguided Ballistic	3 rounds, no effect	N/A, <u>not possible</u>	N/A, <u>not possible</u>
Guided Ballistic	6 rounds, little effect	<u>71 ROUNDS</u> 15 for tgts 1& 2, 56 for suppress zone	4 Minutes
Guided ERGM	27 rounds, Tgt 1 neutralized, Tgts 2, 3 damaged	<u>43 ROUNDS</u> 15 for tgts 1& 2, 28 for suppress zone	1 Minute

ERGM completes scheduled fires in 1/4 the time of guided ballistic, with 40% less rounds



Marine Combined Arms Scenario

(per Hanlon Letter)



Mission: NSFS Offensive Fire Support For Friendly Mechanized Infantry Unit With 3 DDG's for 30 Minute Engagement

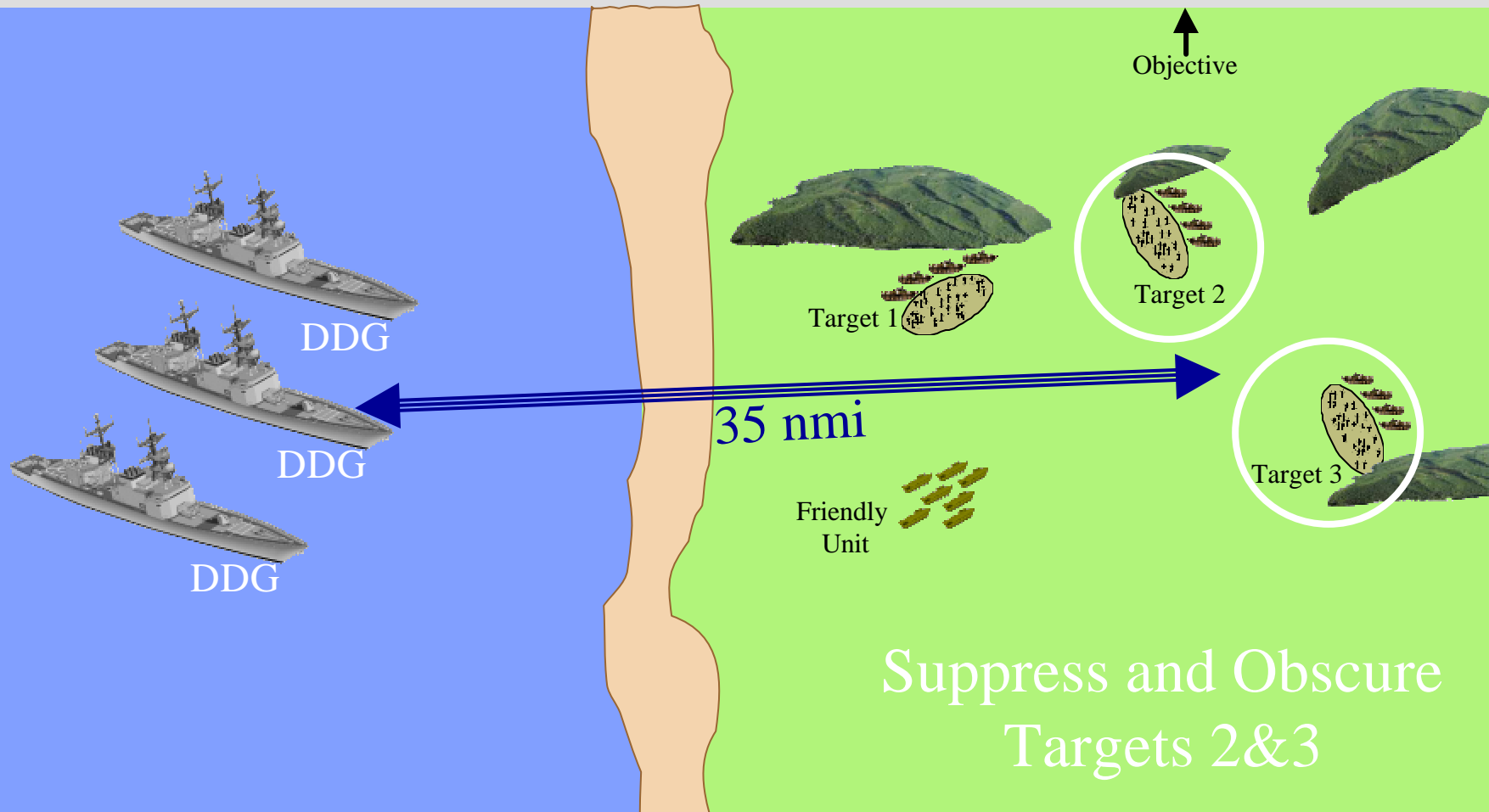
Extended Range Guided Munitions

Raytheon



Marine Combined Arms Scenario

(per Hanlon Letter)

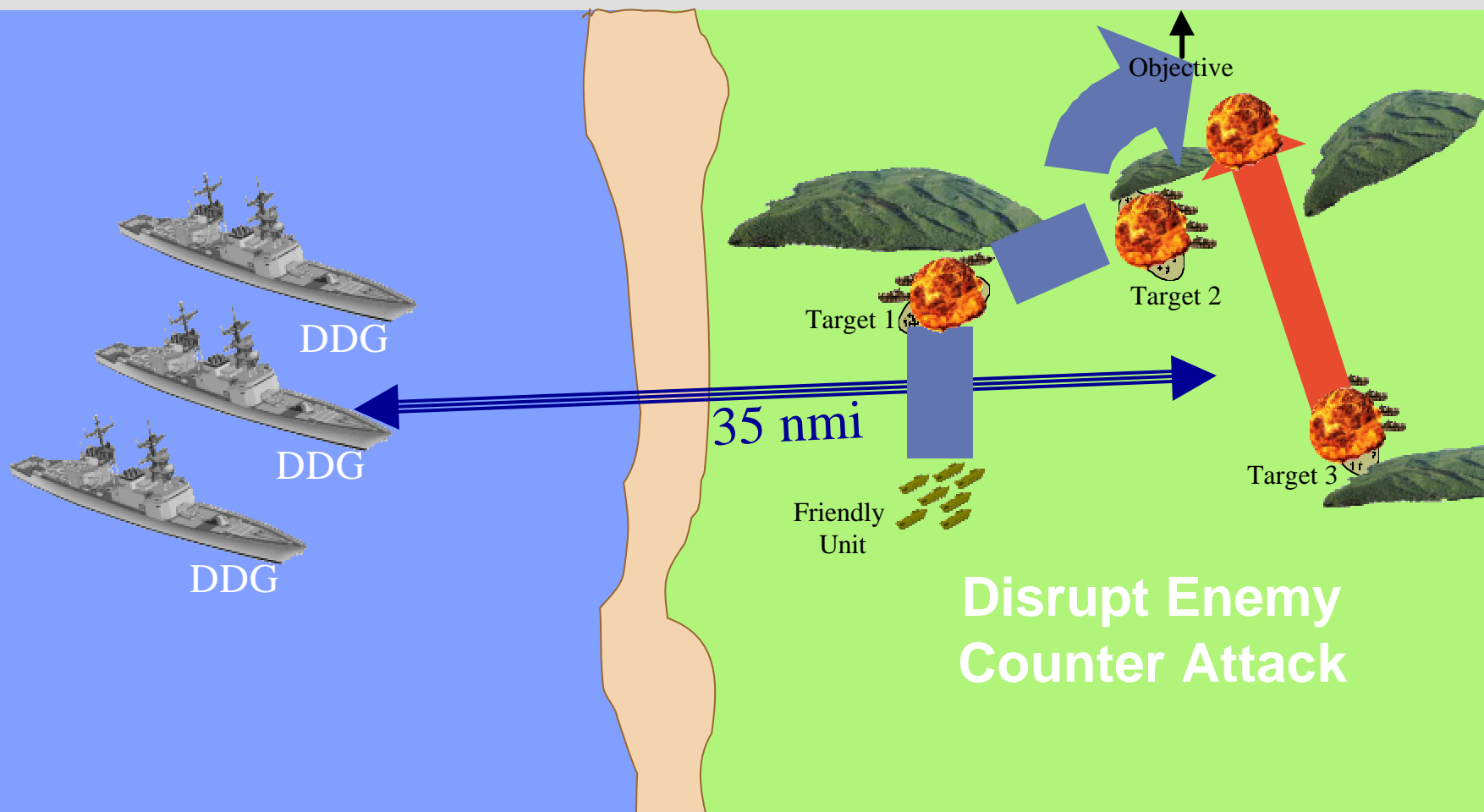


Mission: NSFS Offensive Fire Support For Friendly Mechanized Infantry Unit With 3 DDG's for 30 Minute Engagement



Marine Combined Arms Scenario

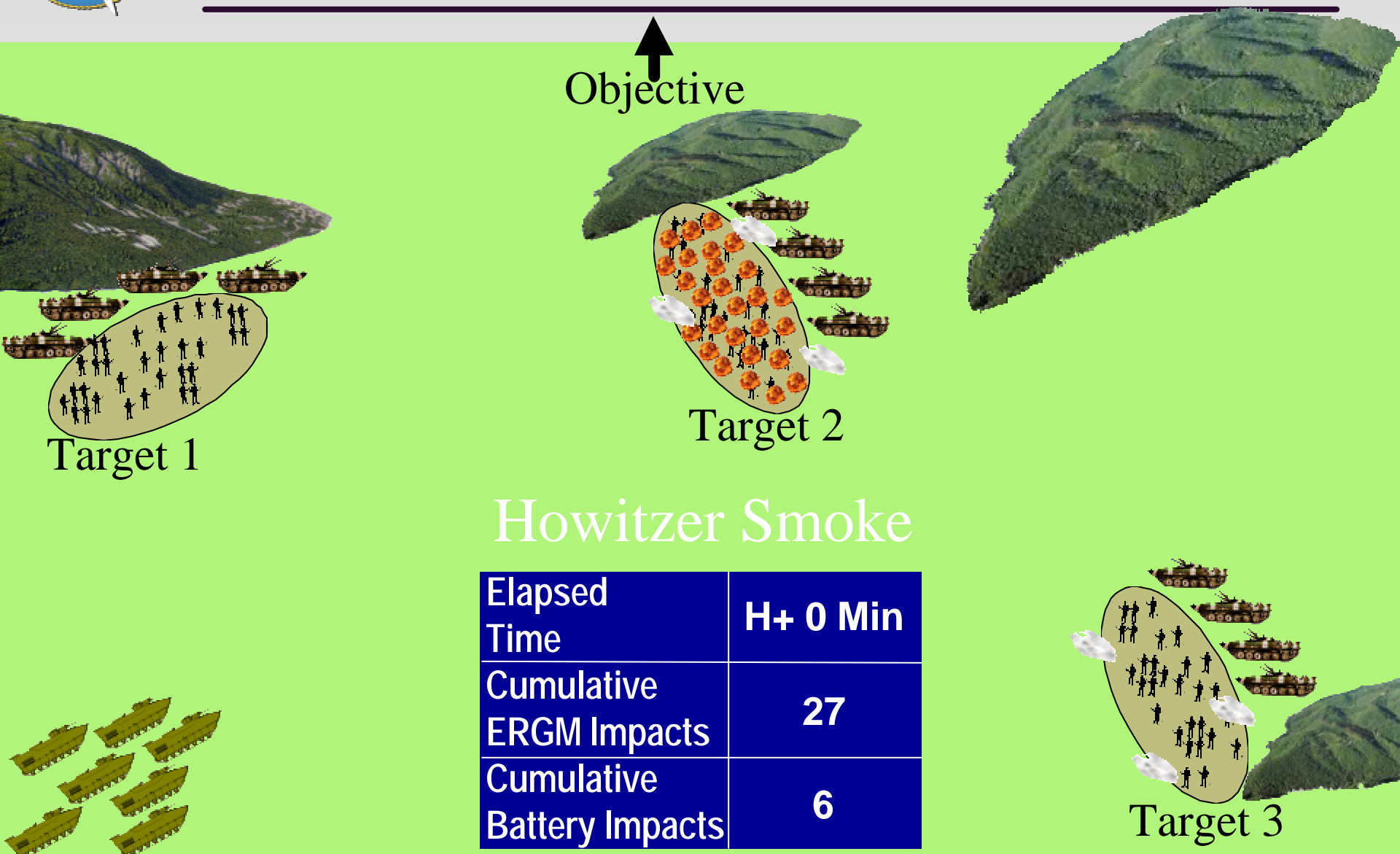
(per Hanlon Letter)



Mission: NSFS Offensive Fire Support For Friendly Mechanized Infantry Unit With 3 DDG's for 30 Minute Engagement



ERGM In Combined Arms Maneuver Warfare

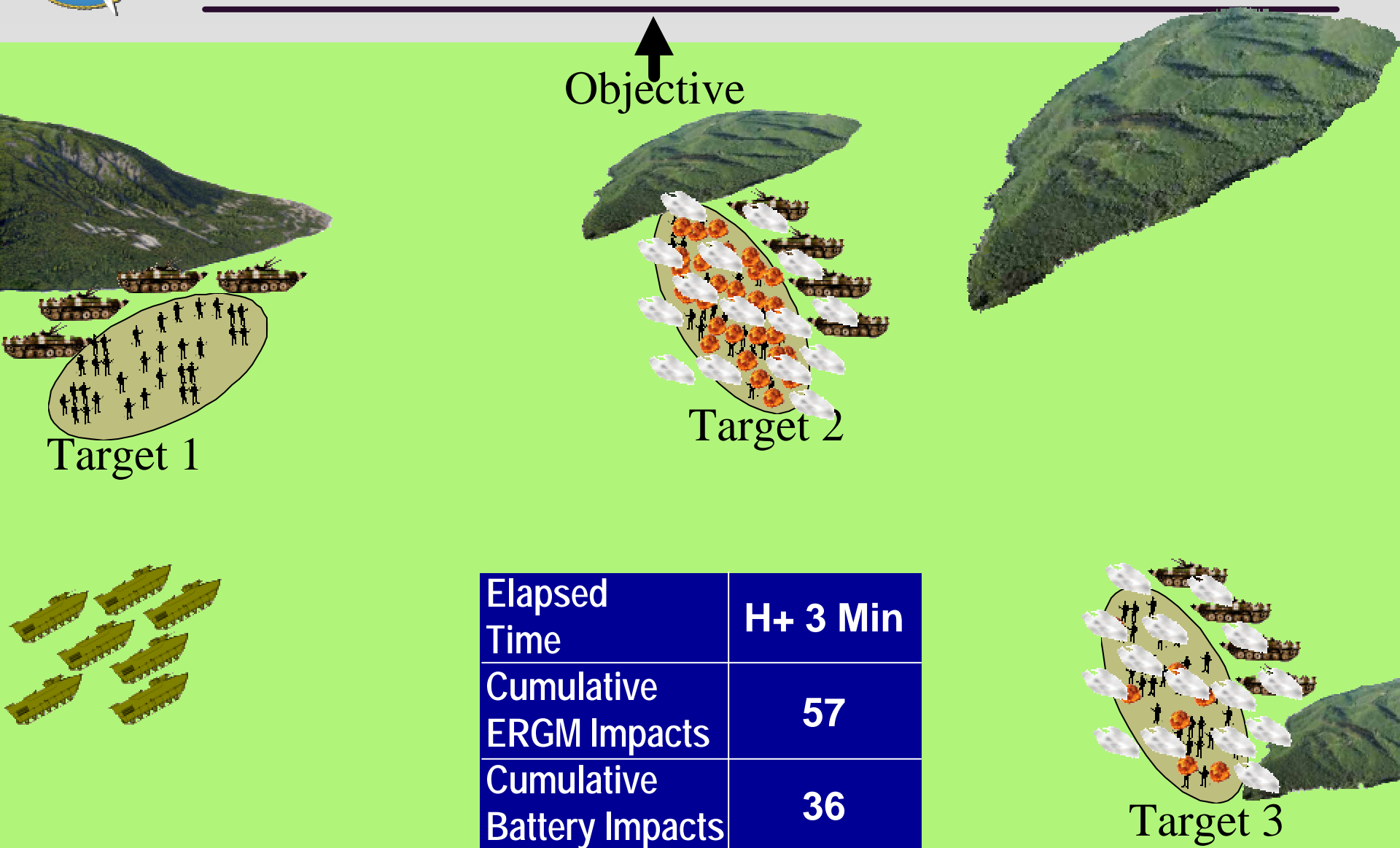


Howitzer Smoke

Elapsed Time	H+ 0 Min
Cumulative ERGM Impacts	27
Cumulative Battery Impacts	6



ERGM In Combined Arms Maneuver Warfare

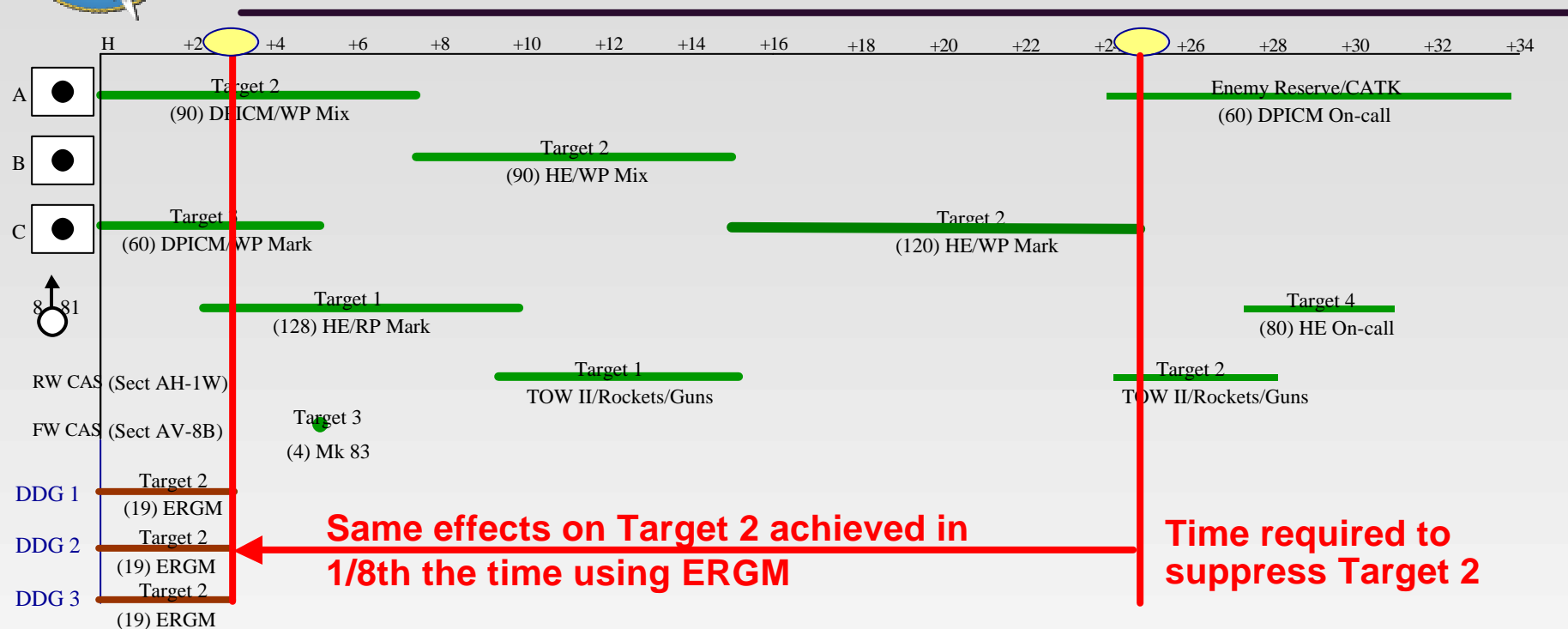


Extended Range Guided Munitions

Raytheon



Schedule of Fires

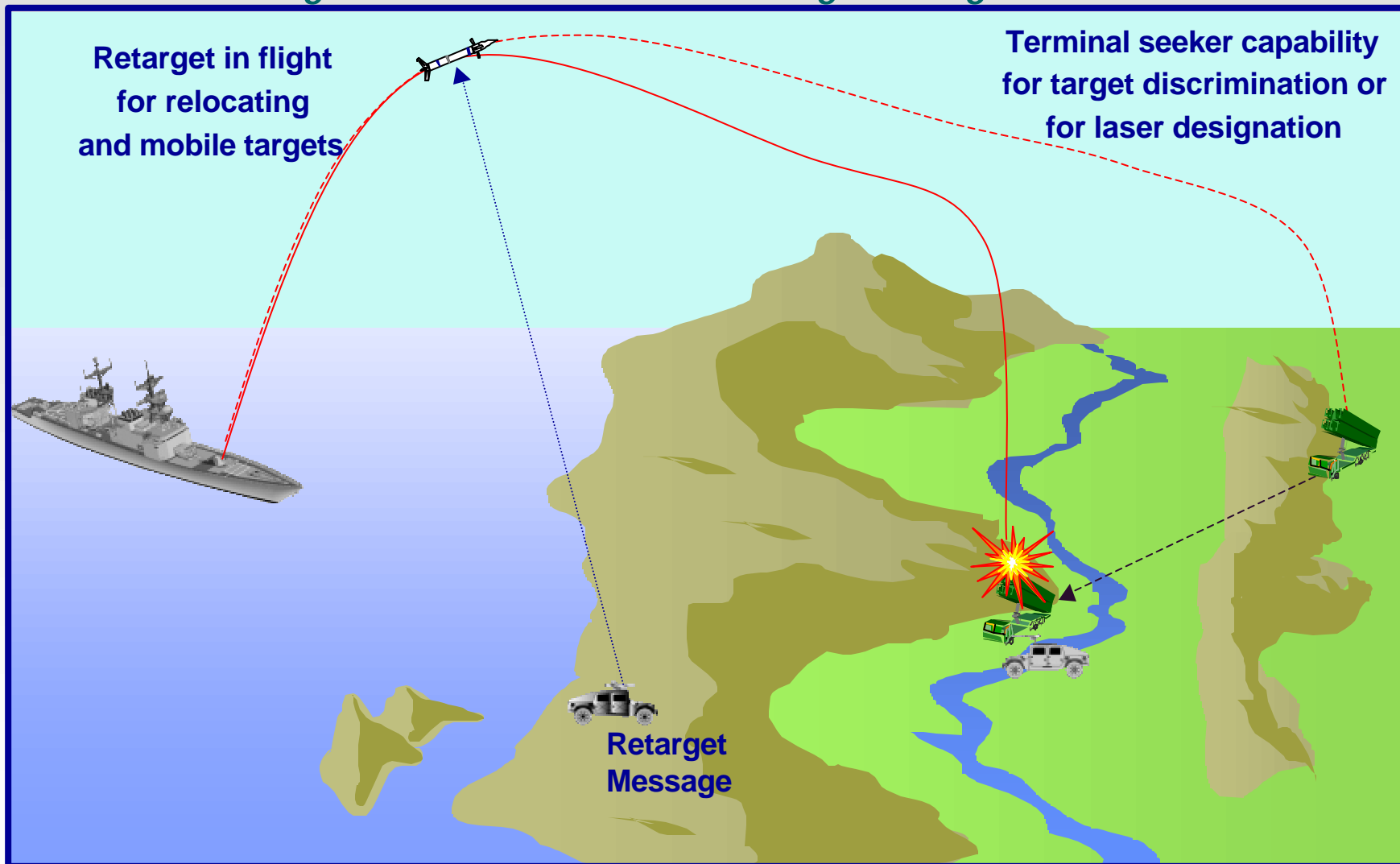


- ERGM use greatly enhances mission success in Hanlon Scenario
- Two 155mm Batteries (255 rounds) available for on demand targets
- Future modeling with this scenario may reveal even greater benefits



Future ERGM Operational Capabilities

Data Link Retarget, Seeker with Automatic Target Recognition or Laser Seeker



Extended Range Guided Munitions

Raytheon



Summary

- **ERGM On Track for Deployment**
 - **Get Capable Round in the Fleet ASAP**
 - Meets ORD Lethality
 - Exceeds Threshold Range
 - Excellent MRSI Capability
- **Volume Fires Mission Met by Guided Projectiles**
 - **First Round Effects is Volume Fire**
 - Flight Control Enables MRSI Capability
 - **ERGM accuracy achieves Volume Fires Effects minimizing danger close range and collateral damage**
 - **Unguided Ballistic Rounds at Long Ranges Unacceptable**
 - Danger Close & Minimal Perception of Danger for Suppression
- **Spiral Development to Make Use of Technology Evolution**
 - **Use Emerging Technologies that Reduce Cost**
 - **Engage Suppliers to Shape the Technology Development**
 - **Improve Capabilities that Meet the Mission Effects Needs**

ERGM IS A REALITY

Extended Range Guided Munitions

Raytheon